F-6912

APPARATUS FOR PRODUCING AN AEROSOL

The invention relates to a apparatus for producing an aerosol in accordance with the introductory portion of claim 1.

The invention is concerned with the problem of creating an apparatus, which is constructed simply, has a high output and produces a particularly homogeneous aerosol. Pursuant to the invention, this objective is accomplished by an apparatus of claim 1. Reference is made to claims 2 to 20 with regard to important further refinements.

The inventive apparatus, which is intended particularly for producing sterilizing and disinfecting aerosols, as used, for example, for the sterilization of packaging means, such as bottles, has a high output and produces a particularly homogeneous aerosol, which is free of droplets. If it exists, for example, of sterile air and peroxide, it has a high sterilizing and disinfecting power.

Further details and effects arise out of the following description and the drawing, in which diagrammatic examples of the inventive aerosol generator are illustrated. In the drawing

Figure 1 shows a diagrammatic representation of a first embodiment of an inventive aerosol generator and

Figure 2 shows a representation similar to that of Figure 1, of a second embodiment of an inventive aerosol generator.

The apparatus, shown in Figure 1, comprises an atomizing container 1, which has, in the lower region, an annular nozzle 2 as a means of forming an annular, bundled gas stream. The annular nozzle 2 has an outer cylindrical ring part 3 and an inner ring part 4, which is disposed in the outer, cylindrical ring part 3, has the shape of a circular conical section and, together with the outer ring part 3, forms the boundary of a nozzle duct 5, which expands in the upward direction and is closed at its underside. A pipeline 6 for supplying the gaseous component of the aerosol, which preferably consists of heated, sterile air, discharges into the nozzle duct 5. The temperature of the sterile air may be, for example, 60° to 80° C. A shut-off valve indicated at 7, preferably is a membrane valve opens up or shuts off the connection to a source of sterile air, which is not shown. It can be actuated manually or preferably by means of an actuator.

In the midst of the annular nozzle 2, an atomizing nozzle 8 is disposed for the liquid component of the aerosol, which preferably is hydrogen peroxide (H_2O_2). The atomizing nozzle 8 may be constructed as a wide slot nozzle and have a nozzle slot 9, which passes radially through a nozzle body 10 and is located approximately at the level of the upper edge of the inner ring part 4 of the annular nozzle 2. Instead, the atomizer nozzle may also have a normal construction with a nozzle duct, which is circular in cross section.

The atomizer container 1 has a basic cylindrical shape. In Figure 1, the bottom of the atomizer container 1 changes over into the upper end of a measuring container 11 for the liquid component for the aerosol, so that the peroxide, depositing at the inside of the atomizing containing 1 due to condensation, can run back directly into the measuring container 11. At the lid side, the container 1 is provided with an outlet opening 12 for the aerosol produced. A discharging pipe line 22, leading to the place of use, can be connected to the outlet opening 12. An inspection opening, closed off by a sight glass 13, is provided in the side wall of the atomizing container 1.

A connecting line 14, in which a pump 15, preferably a membrane pump, is connected, comes out of the lower end of the measuring container 11. This connecting line 14 is passed through the side wall of the container into the atomizing container 1 and, at its end, carries the atomizing nozzle 8.

Furthermore, a connecting line 16, which connects the measuring container 11 to a (shown diagrammatically on a smaller scale) reservoir 17 for the liquid component of the aerosol discharges into the lower region of the measuring container 11. A valve 18 in the connection line 16 controls the flow into the measuring container 11. In the construction of Figure 1, the latter has upper and lower limit contacts 20, which are disposed spaced apart above one another, as well as a float 21, which interacts with the limit contacts. The consumption of the liquid aerosol component is checked over the level contacts 19 with the help of the float 21 and the replacement of the liquid aerosol component over the supply valve 18 is controlled over the limit contacts 20.

While the apparatus is being operated, the annular nozzle 2 forms an annular, bundled, upwardly directed current of air, which takes up the mist-like aerosol component emerging from the atomizing nozzle 8 and mixes intimately with this component. The extremely homogeneous aerosol is practically free of droplets at the outlet. The output of the apparatus is high and an aerosol is produced which, when it consists of sterile air and peroxide, offers a high sterilizing and disinfecting effect.

In the construction of Figure 2, the measuring container 11 is set up separately. The lower end of the atomizing container 1 is connected to the supplying pipeline 6 for the gaseous component and, as a means for forming a current of gas, comprises a number of screens, which are disposed one on top of the other and combined into a screen package 23. The individual screens preferably consist of an interwoven mesh of stainless steel wire. As it flows through the screen package 23, the current of gas experiences a cylindrical bundling and is also aligned coaxially to the atomizing nozzle 8, around which an extremely, uniform current of gas is flowing.

The supplying pipeline 6 for the gaseous component starts out from a reservoir, the details of which are not shown and the gaseous content of which, such as sterile air, may be under a specified pressure. On its way to the atomizing container 1, the gaseous component in the supplying pipeline 6 passes through a heating unit 24. The supplying pipeline 6 passes through an elbow 25 laterally into a straight part 26 of an approximately T-shaped connecting piece 27. Moreover, the supplying pipeline 26 is connected below the screen package coaxially to the lower

end of the atomizing container 1 and is connected over a return pipeline 28 with the upper end of the separate measuring container 11 for the liquid component of the aerosol.

A heating unit 29 may also be connected in the discharging pipeline 22, which is connected to the upper end of the atomizing container 1, in order to ensure that the aerosol has the desired temperature when it reaches its place of use, such as a bottle sterilization station.

A shut-off valve 30, which can be actuated preferably by means of an actuator, is provided in the pipeline 6 for the gaseous component. There may also be such a shut-off valve 31 in the discharging pipeline 22 in front of or behind the heating unit 29.

At the bottom, the measuring container 11 is connected over the pipeline 16 to a reservoir for the liquid component of the aerosol which, in the case of the embodiment of Figure 2, is pumped by means of a pump 32, as needed into the measuring container 11. In the case of the embodiment of Figure 2, the measuring container 11 is provided with a capacitive probe 33, which controls re-filling of the measuring container 11, when an appropriate level is reached and, furthermore, enables the consumption of liquid aerosol component to be determined. An accurate determination of the consumption is provided by a flow meter 34, which is connected in the connecting pipeline 14. A venting pipeline is indicated at 35 and a valve-controlled pipeline 36 enables the measuring container 11 to be emptied completely.

When the apparatus is being operated, a droplet-free, fine, uniform aerosol is formed in the atomizing container 1 and can be supplied by the discharging pipeline 22 to the intended use and ensures that the surfaces, which are to be sterilized, are wetted completely there. A cycled aerosol formation process can be carried with the help of the shut-off valve 30. Such a process can also be carried out when the shut-off valve 30 is open and the shut-off valve 31 is opened and closed cyclically. Any condensate, which may have collected in the lower region of the pipeline section 26 is transferred in the latter cyclic operation over the return line 28 into the upper region of the measuring container 11 by the overpressure of the gaseous component in the system. In the event of a cyclic operation with the help of the shut-off valve 30, the measuring container 11 advisably is set up below the connecting part 27, so that the condensate can be returned through pipeline 28 by gravity without requiring a pump.

However, such a return of condensate need be carried out only rarely, since condensate of liquid aerosol components, in normal operation, drains from the atomizing container 1 into the screen package 23 where it is collected, dispersed, and taken up and carried along by the flow of the gaseous component, as soon as there is an appropriate flow.

In the case of a non-cyclic, continues operation, the screen package 23 ensures that, as a rule, the whole of the condensate is retained in the region of the screen package 23, dispersed, and taken up by the gas stream and nothing goes over into the pipeline section 26, from where it would then be returned to the measuring container 11.